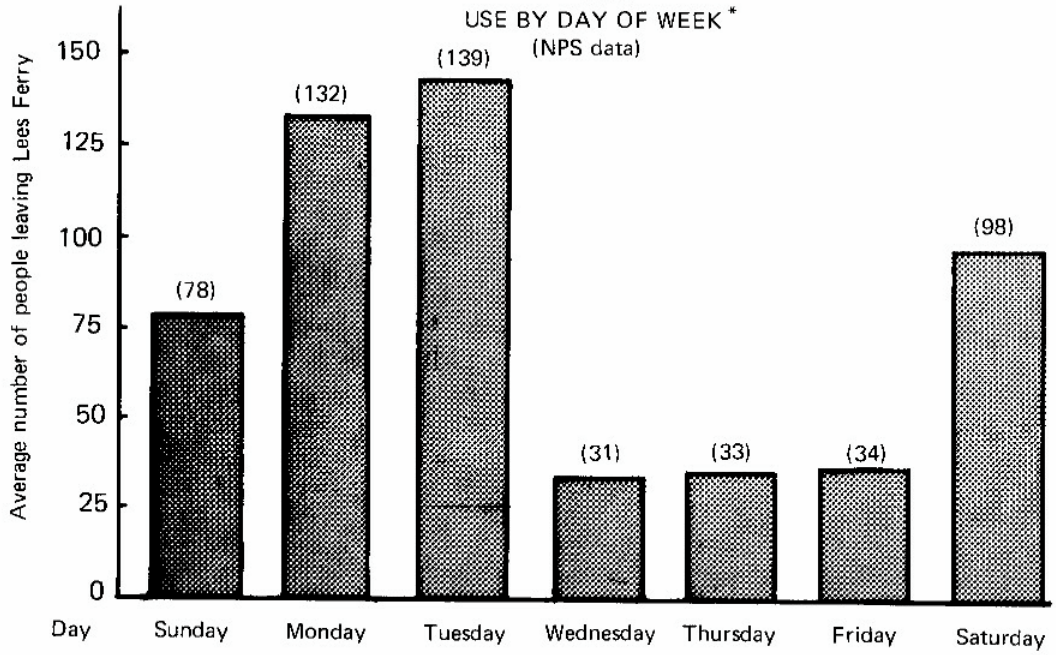
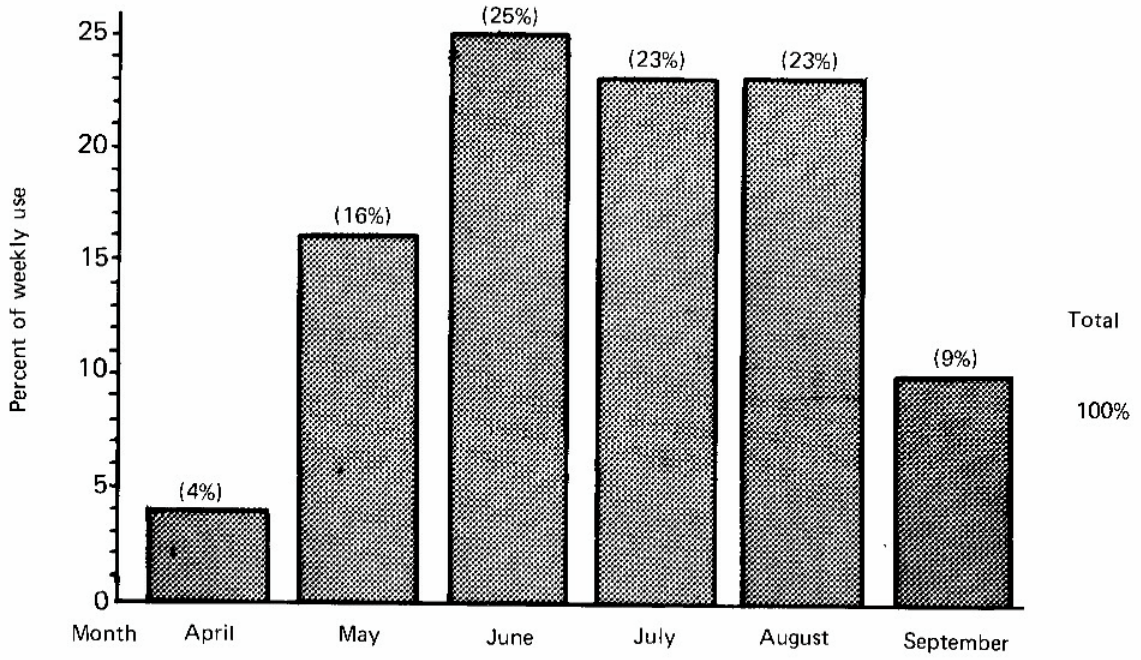
TABLE 17
USE BY DAY OF WEEK *
(NPS data)



	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Percent of weekly use	14	24	26	6	6	6	18

*April through September only

TABLE 18
USE BY MONTH OF SEASON*
(NPS data)



	April	May	June	July	August	September	
Average Number of people leaving Lees Ferry	(487)	(2,193)	(3,398)	(3,104)	(3,127)	(1,277)	13,586

*April through September only

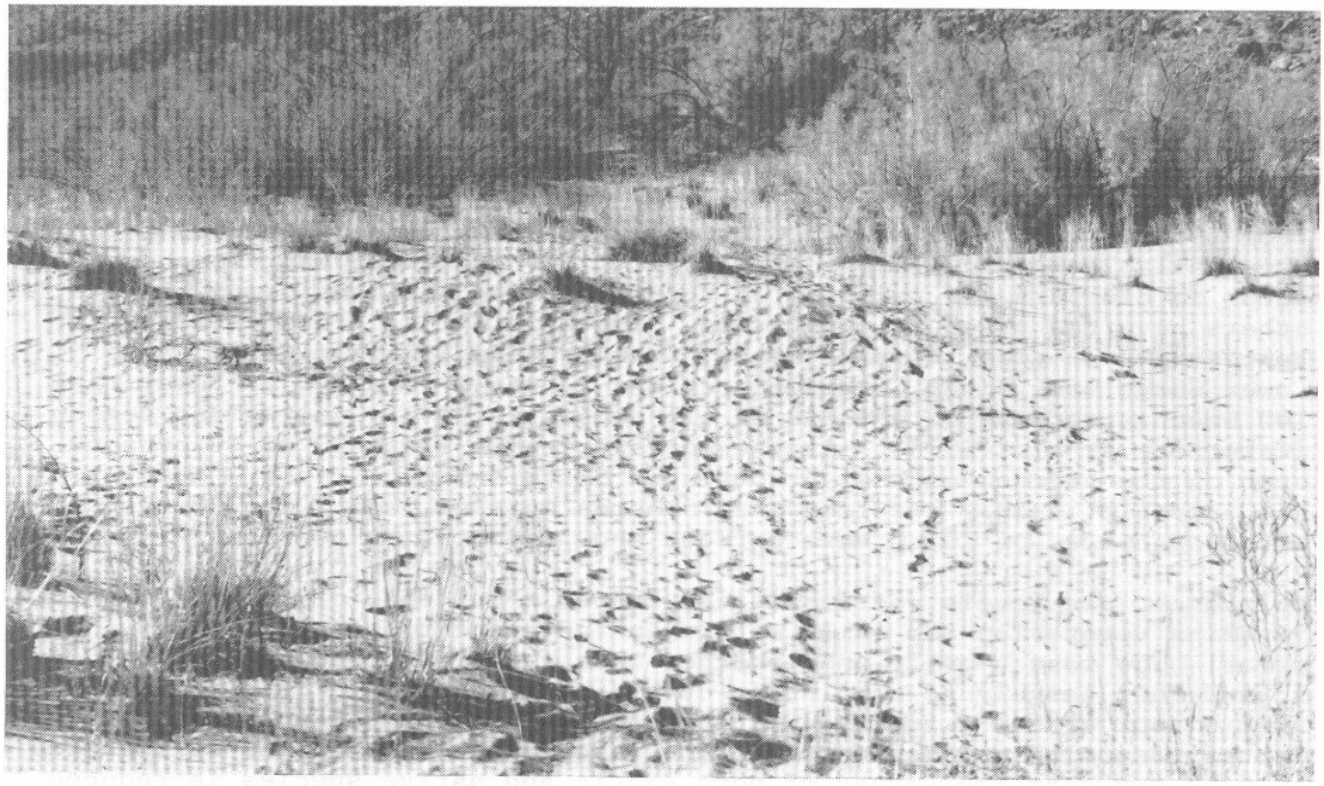
1. Beaches

From Lees Ferry to Grand Wash Cliffs (277 river miles), about 400 campsites are available for an average of 1.4 per mile. However, most beaches occur in clusters and portions of the river have abundant camps while others have few or no camping areas. The critical sections with few beaches are in upper Marble Canyon, Granite Gorge, Marble Gorge, and Lower Gorge (see River Corridor sections, pages I-4 to I-6). Fewer than 100 beaches receive 75 percent of all camping activity during one season (Carothers et al., 1976). At the more desirable sites 30 to 40 persons camp on the beaches each night during a 3- to 4-month season. Most of the campable beaches are less than 5 acres in size, and 20 to 30 campsites with capacities of 20 or more persons show impact from overuse.

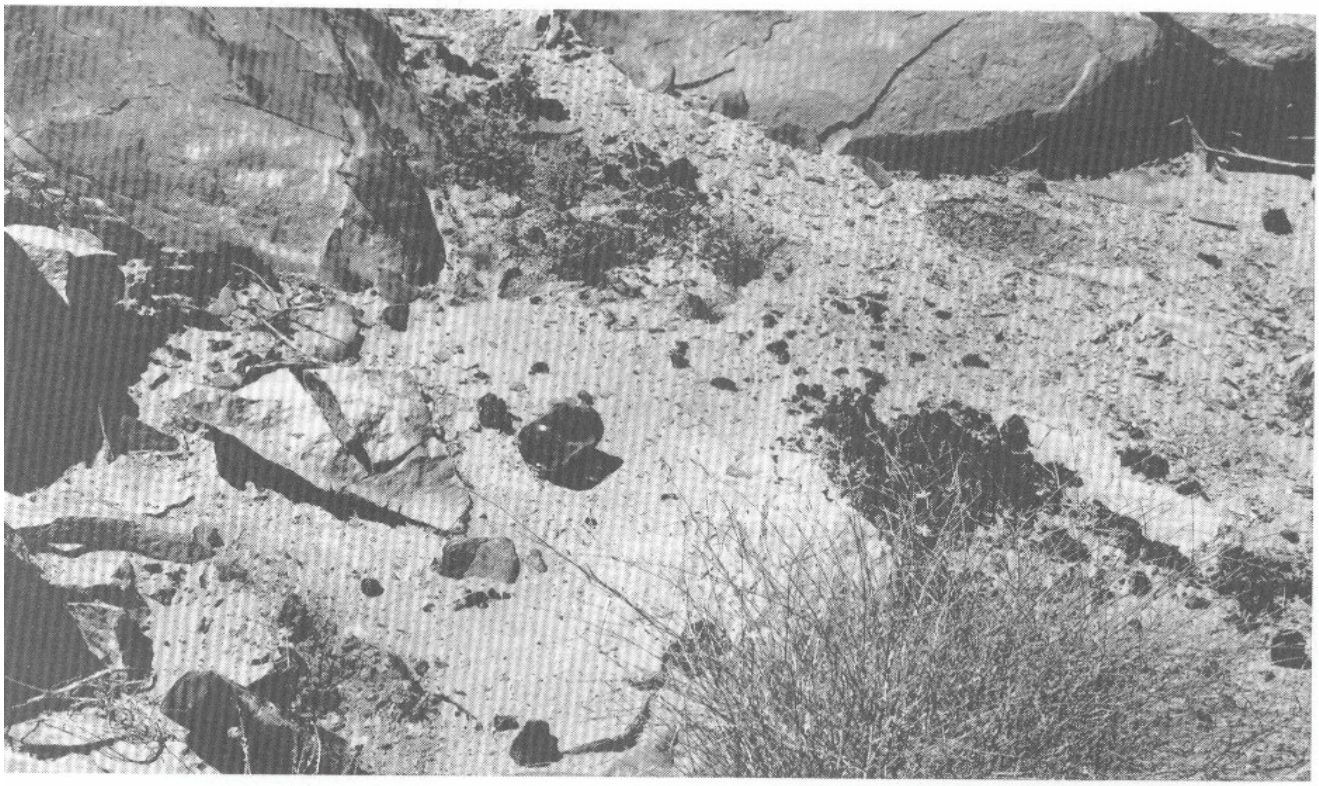
At present use levels and densities, there is evidence of impact on the riparian vegetation and soils within and adjacent to popular beach areas. The most heavily used beaches have areas of 2,500 to 10,000 square feet largely to completely devoid of vegetation. This results from direct stress associated with people walking on the unstable sedimentary deposits and vegetation. The vegetation is sometimes so impacted by visitors that the spread of both exotic and native species is reduced or eliminated. This may be either through destruction of the plants themselves or by foot traffic disturbing the soil structure. However, without some visitor activity, many campable areas would become overgrown and not suitable for camping (Howard and Dolan, 1976; Carothers and Aitchison, 1976).

Most of the foot traffic on the prime camping beaches is concentrated within 100 meters of the mooring sites and decreases outward exponentially with distance. Use is concentrated along pathways that radiate outward from the main campsite. These pathways are commonly .75 to 1.25 meters deep. The foot traffic to and from boats and camps dislodges beach material downslope and roughens beach material which increases turbulence at bed surface. Both of these factors accelerate erosion of beach material (Howard and Dolan, 1976). Human debris (food particles, plastic, pop-tops, etc.) is being incorporated into the sand/silt deposits at rates that exceed the purging capacities by natural processes, causing beaches to look and smell like sandboxes found in heavily used public parks.

Also significant has been the rate of incorporation of charcoal and ash into beach deposits, despite current regulations for fire pans. The charcoal has spilled out of the pan or thrown into the river and redeposited on downstream beaches or transported by wind up and onto campsites (Howard and Dolan, 1976).



Foot Traffic on Beaches



Charcoal and Debris on Beach

2. Off-River Use and Attraction Sites

Off-river activities are important factors in the visitor's experience. Many spectacular side canyons, river overlooks, and historical and archeological sites are easily reached from the river. Heavy visitation has resulted in resource impacts and visitation to some restricted areas.

Variable rates of travel, trip length, number of people leaving Lees Ferry, and type and amount of off-river activities such as hiking and camping contribute to resource impacts directly related to congestion and crowding at attraction sites.

On commercial motorized trips of 7 days or less in length, little time is spent off-river. On longer commercial motorized trips or on oar powered trips an average of one-third of each day is spent hiking to attraction sites. Also, some groups hike overnight to off-river sites.

Private trips average 17.5 days per trip. As many as 15 days are spent hiking to off-river sites. Currently, there is no limit for length of off-river use or maximum length of river trip, except that no more than two nights may be spent in any one location.

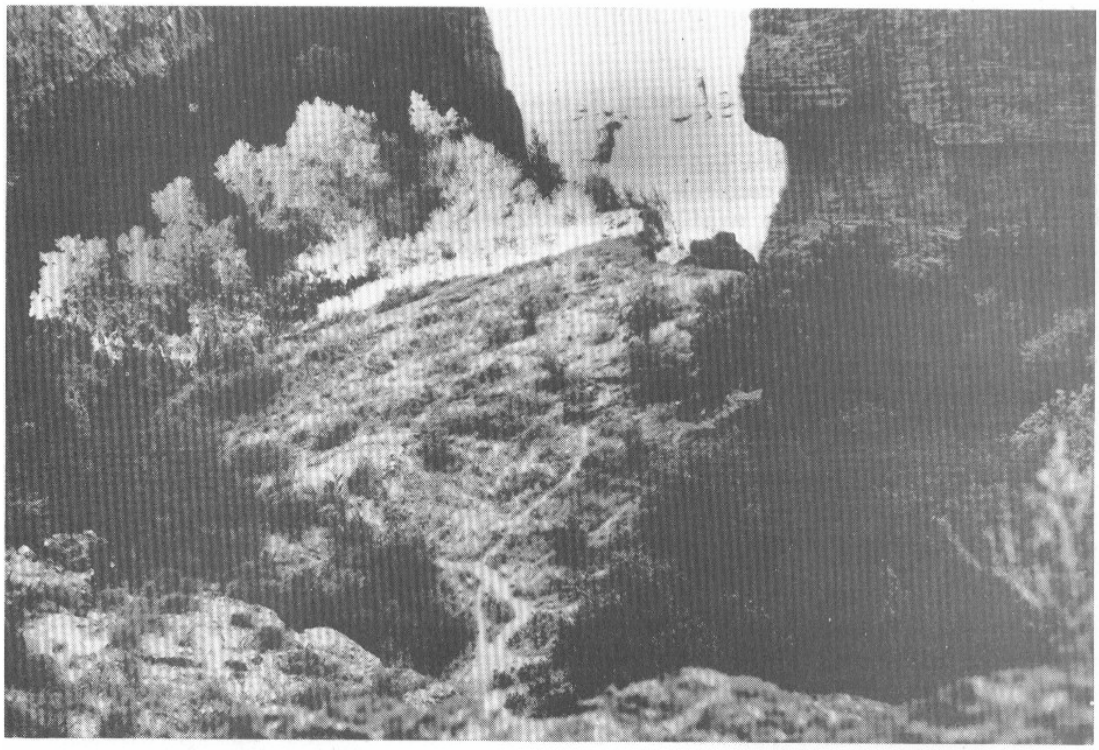
Noncommercial users visit more off-river attraction sites than commercial users, but commercial oar trips spend more time at particular sites. Table 19 presents data on the relative differences in attraction site visitation for commercial (oar and motor) and noncommercial (virtually all oar) river trips.

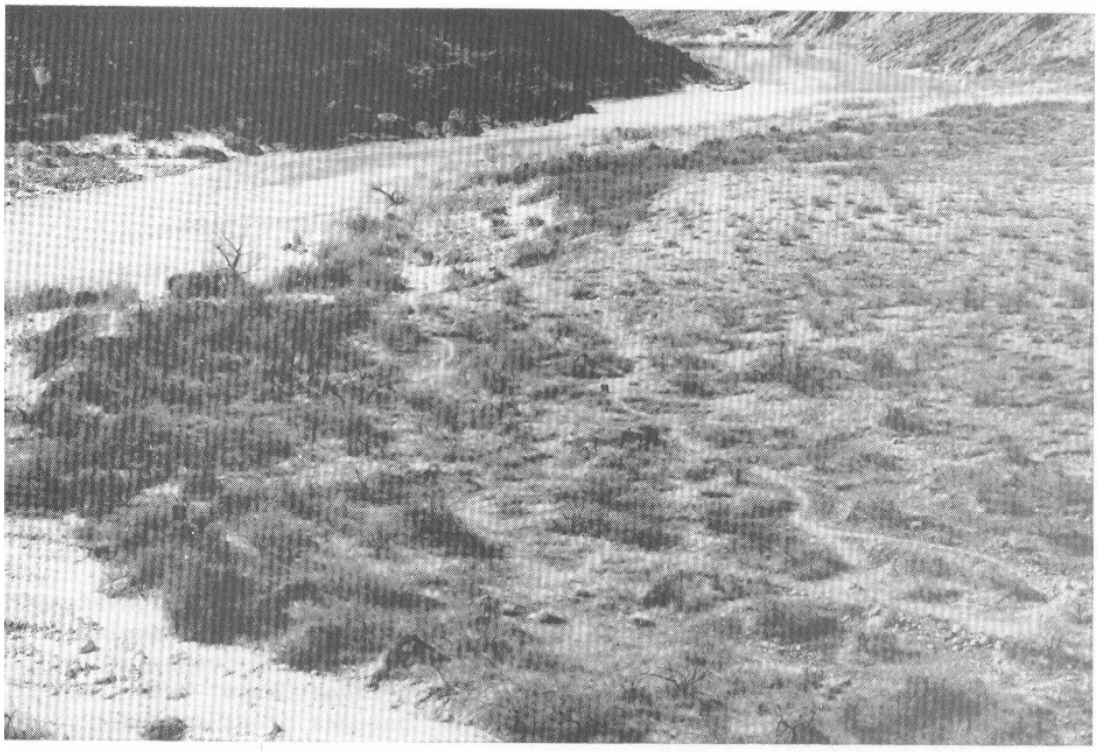
Table 19
ATTRACTION SITE VISITATION BY COMMERCIAL
AND NONCOMMERCIAL RIVER TRAVELERS

	Commercial		Noncommercial
	Motor	Oar	All Trips
Total number of sites visited	12.1	17.0	21.3
Average length of visit (hours)	1.3	6.0	3.9

(after Shelby and Nielsen, 1976)

High visitor densities at prime attraction sites impact both the physical and biological resource as well as visitor satisfaction. For example, two or three river parties (40 to 60 persons) may meet and congregate at such popular sites as the Little Colorado River, Elves Chasm, Deer Creek Falls, or Havasu Creek. Encounters with other parties occur at about





Examples of Multiple Trailing

half of all other sites visited. When groups arrive at attraction sites at the same time, they tend to use different access routes from the river to and from the site to avoid inter-group contact. The chaotic patterns of foot traffic to side canyons, attraction sites, and beaches have resulted in severe vegetation damage and soil disturbance. Multiple trails, trampled vegetation and aeolian erosion are evident at all prime attraction sites.

3. Partial Trips

There are currently a considerable number of commercial passengers taking partial river trips. Most partial trips end or begin at Phantom Ranch. Many people take what amounts to a partial trip by taking out at Lava Falls. This trip is generally advertised as a full-canyon trip even though it takes out two thirds of the way through the canyon. In 1978, there were 3,481 people who hiked in or out from river trips. Table 20 shows the number of people who took partial river trips in 1978 and the locations they began or ended their river trip.

Table 20
PARTIAL TRIPS TAKEN WITH CONCESSIONERS 1978

	Passengers In	Passengers Out
Lees Ferry	11,335	
Phantom Ranch	1,271	1,251
Little Colorado	10	1
Hance	17	0
Tapeats	0	13
Havasu	89	56
Lava Falls	419	3,097
Whitmore Wash	109	664

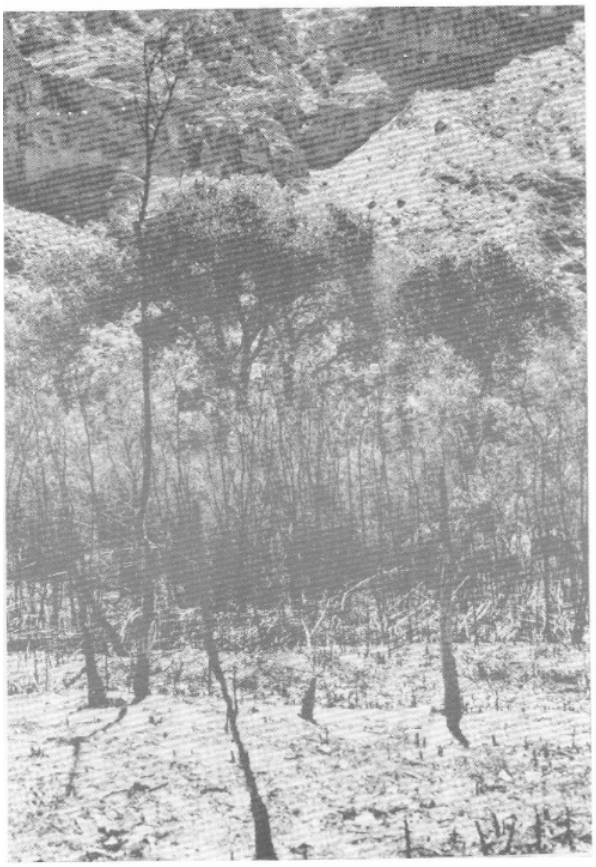
Exchanges at Lava Falls involve the use of a helicopter to get to or from the river. The helicopter operates from lands just outside the park boundary.

4. Fire

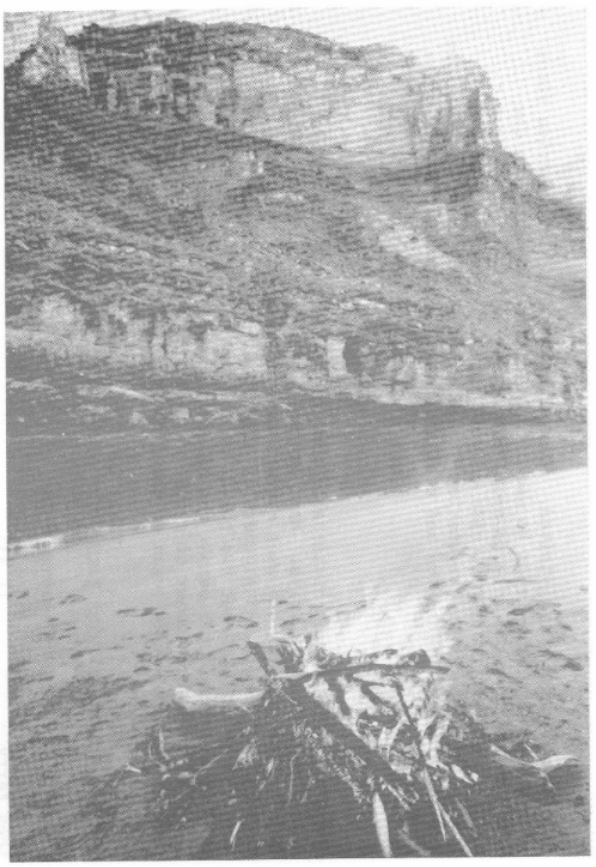
The use of wood fires for cooking, recreation (campfire talks, etc.) and warmth has been a common practice of river runners during all seasons of the year. Research findings indicate that major resource management problems were associated with this use of fire, such as:

- Depletion of the firewood supply (driftwood) occurring at a rate exceeding the natural replenishment rates.

- Removal of driftwood piles affects certain wildlife resources (particularly reptiles).



Results of wildfire started by River Runner



Illegal Fire - No Firepan

- The ash and charcoal resulting from combustion of the firewood being incorporated into the beaches at a rate that far exceeded the natural purging processes that clean beach sands.

- Standing and fallen dead trees native to the canyon were being used for firewood.

- Brush fires have been caused by the careless incineration of toilet tissue.

Although the previous regulations regarding the use of fire were designed to prevent resource impacts, these regulations were (a) not always followed, (b) difficult to enforce, and (c) not adequate for the variety of situations that developed during river trips.

5. Sanitation

The primary sanitation problem that existed as a result of the river recreation practices was the disposal of human waste. Past regulations required that all organic and inorganic garbage be carried out of the canyon, but allowed for the burial of human body waste Under existing visitor use levels, approximately 20 tons of fecal materials were buried

National Park Service river regulations required that all river trips carry a portable toilet or other means of containerization of human waste, and that these wastes be buried at least 200 feet from any area normally used for camping, 6 feet above the normal high water mark at least 50 feet from the riverbank, and the hole itself be at least 2 feet deep.

At many popular camping areas, it was physically impossible to bury the wastes according to regulation; in fact, 18 sites were placed off limits to sewage burial because they were not 200 feet long or wide, and there were no areas, other than the immediate camping area, where a burial site could be located. under this situation, river parties were instructed to carry their waste products to another site downstream where burial according to regulations was possible. these regulations were often not observed, frequently resulting in waste burial sites being located in the center of a camp.

Burying waste products resulted in potential health and actual esthetic problems. because of colloidal interactions between feces, beach sand, and water, some burial sites do not drain adequately, resulting in feces being buried only a few inches below the soil surface rather than 2 feet down in the burial hole. Wind would uncover the feces, resulting in noxious smells and visual impacts on visitors. The actual pathogenic hazard potential of the burial sites is relatively short-lived. Sartor Lynch and phillips (1976) determined that 99.98 percent of the viable fecal coliforms perished within the first month of burial and that it is

unlikely that contamination from this source could persist from one season to another. Nevertheless, with some of the more popular camping areas used almost every night during the height of the river running season, potential health problems existed. Recent research (K. Johnson, 1976 and Knudsen, 1976) indicates the following:

- The health of river runners was potentially endangered due to the numbers of fecal coliform bacteria and associated pathogens which were found capable of surviving up to 11 months of burial in porta-potty dump sites located on or near camping beaches.

- Fecal contaminants were not restricted to the actual porta-potty dumpsite, but have been found to migrate up to 8 inches away from the dumpsite.

- Random sand samples taken from sleeping, eating, and cooking areas at some campsites contained viable fecal coliform bacteria.

- The disinfectant chemicals used in porta-potties do not provide for total disinfection of pathogens associated with fecal wastes.

- Viable fecal coliform bacteria have been isolated from the top 3 to 6 inches of porta-potty dumpsites.

Under past use levels and patterns, over 5,000 human waste burial sites annually were dug in the beaches of the Colorado River. At the more heavily used campsites, it was not uncommon for a boatman to unearth the remains of the previous group's fecal dumpsite when attempting to bury wastes. Many of these campsites, for example the Deer Creek Camp (River Mile 136, left), were receiving up to 150 separate dumps each river season in an area of less than 5 acres.

Associated with improper disposal of the fecal wastes was the improper disposal of toilet tissue, sanitary napkins and tampons which, along with raw feces, could be found in surface beach deposits at most of the heavily used sites. In some cases, they were not associated with portable toilet dumps. These materials are not always placed in the present carry out containers.

There is also a serious esthetic and possible infectious contamination problem associated with human waste disposal in all backcountry areas of the Grand Canyon where visitors congregate. This problem is accentuated by allowing indiscriminate disposal of fecal materials when the parties are away from the river.

It should be noted that the proposed action of requiring all river runners to carry out their human waste was implemented in the 1978 season. The river monitoring studies conducted in 1978 showed significant improvement in beach cleanliness.

6. Fishing

Fishing has not been a major activity. However, interest in trout fishing is increasing because rainbow trout of 5 to 8 lbs. are commonly being caught and some up to 18 lbs. have been caught recently. This has the potential for developing considerable interest in fall and winter trips when fishing success is highest. Fishing occurs along the river and in some of the major tributaries; e.g., Bright Angel and Tapeats Creeks. The common fish are rainbow trout, channel cat, carp, striped bass, walleye, and occasionally brook trout and Coho salmon. All these fish have been introduced to the river through stocking at Lake Mead, Lees Ferry, Diamond Creek, and the major tributaries within the park. The humpback chub is an endangered species occasionally caught on hook and line.

Fishing in the backwaters of Lake Mead is a popular activity in the lower gorge. For approximately half of the 12,000 lake recreationists, fishing is either a main or an incidental pursuit.

N. SOCIAL FACTORS

1. commercial Passengers

The commercial passengers that annually make passage of the Colorado river through Grand Canyon are a select socioeconomic group.

Commercial river-running passengers in Grand Canyon have above average income levels, with over half the people reporting family incomes over $24,000 Education level is also high, with 78 percent having at least some college and 53 percent possessing a bachelor's or more advanced degree.

Average age of river runners is 33, 43 percent are married, and half are woman. The majority (64 percent) currently live in large cities or suburban areas. Only 22 percent belong to an outdoor club or conservation organization, and for a sizable portion (31 percent), the Colorado River trip represents their first wilderness expedition and for the overwhelming majority (91 percent) the river trip represents their first float down the Colorado (Shelby and Nielsen, 1976).

It has been reported in the "Congressional Record" that restricting river travel to non-motorized craft only, would eliminate a particular socioeconomic/demographic group of park visitors traveling the Colorado River. Studies show, however, that this appears unlikely (Shelby and Nielsen, 1976). Although the demographic characteristics indicate that the commercial passenger is from a fairly select group, there are only minor pre-trip background differences between passengers that select motorized trips and non-motorized trips. That is, the social demographic factors which act to "select" river travelers in general are the same for passengers on all commercial trips, regardless of mode of river craft locomotion.

2. Private or Noncommercial Passengers

There are differences in the socioeconomic/demographic characteristics between noncommercial and commercial river trip passengers (Shelby and Nielsen, 1976). Noncommercial river runners in Grand Canyon have slightly lower incomes (half report incomes over $16,000), are more predominately male (77 percent), are generally slightly younger in age, and are less likely to live in cities. Noncommercial users are more likely to belong to *outdoor* groups, and have had more wilderness experiences and began having them at an earlier age. The noncommercial user also has more experience running rivers and is more likely to have had prior experience on the Colorado River; about 70 percent of 1977 applicants have been on at least one and some have been on as many as 100 Colorado River trips (Grand Canyon National Park data).

3. Lower Gorge Users

Visitor characteristics in this zone are of two types. Those continuing their trip from Lees Ferry would have the characteristics described for that area. The remainder can be described by the Arizona Statewide Comprehensive Outdoor Recreation Plan (1975). They have incomes between $10,000 and $15,000, and the median size family is 2.21 members. Most of the visitors come for active water-based recreation, such as water skiing and motorboating.

4. Visitor Perceptions and Preferences

a. Mode of Travel

There are a number of structural differences between the usual motor and oar trips. Motor trips are larger, have more people per boat, have a higher passenger/guide ratio, have more contact with other parties each day, spend less time in the canyon, make fewer and shorter side stops, and make more adjustments for crowding (Shelby and Nielsen, 1976). Adjustments for crowding are defined as occurring whenever trips went farther or faster than planned, slowed down, changed the location of a planned campsite, or passed up attraction sites because of the presence of others.

Table 21
COMPARISON OF MOTOR AND OAR TRIPS

Average	Group Size	Boat Size	Number of Boats	Persons Per Boat	Trip Length	Number of Boatman
Motor Trip	30	30 - 37 ft.	2	15	7	2
Oar Trip	24	15 - 22 ft.	5	5	14	5
Noncom-mercial Groups (mostly oar)	12	small/varied	6	2	17	0

Sixty-one percent of those on motor trips and 1 percent of those on oar trips prefer motorized travel. Experimental trips were conducted in the summer of 1975 to further define the motor-oar differences. The procedure involved a combination trip in which one group of passengers spent the first half of their trip in oar-powered boats, while another group traveled in motorboats. The oar-powered boats left two days ahead, and were met by the motorboats about halfway through the canyon; passengers then switched boats. This provided data from a group of people with both motor and oar experience. This procedure was carried out twice, once in July and once in August. Passengers on combination trips, who had experience with both motor and oar travel in the canyon, preferred the oar trip. In response to four different items, 79 to 91 percent chose oar travel and 4 to 6 percent chose motor travel (Shelby and Nielsen, 1976).

The most frequently expressed explanations for preferring the nonmotorized trip involved the slower, more relaxed pace; the opportunity to become aware of the natural sounds and water movements without the drive of the engine; the smaller, more comfortable social groupings; and the feeling of a more sensitive, esthetic experience. People described the motorized trip as speedy, hurried, rushed, noisy, loud, crowded, big, and wet, but also as fun and exciting. By contrast, non-motorized travel was described as leisurely, slow, lazy, relaxing, peaceful, quiet, silent, natural, friendly, individualized, intimate, and again fun and exciting.

Additionally, it has been determined that passengers on non-motorized trips know more about the canyon; i.e., natural history, geography, special attraction sites, etc., than do passengers on motorized trips. This may be due to increased learning opportunities related to mode of travel (motor noise is detrimental to normal relaxed communication between the guide and passengers), length or speed of the trip, or a difference in knowledge before the trip.

b. Crowding

The vast majority (91 percent) of river travelers define their river trip as a wilderness experience and most do not perceive the canyon as crowded.

> "Thirty percent of the visitors see the canyon as crowded, but this is unrelated to the number of people they saw during their trip. The lack of relationship between contacts, perceived crowding, and satisfaction is attributed to the lack of agreement about how crowded the canyon 'should' be. Most river runners are making the trip for the first time; over half didn't know what to expect in terms of contacts with other groups, and there was little consensus among those who had some expectations." (Shelby and Nielsen, 1976)

Most people (65 percent) prefer two or less contacts per day and 90 percent prefer to camp away from others. Small travel groups are considered most appropriate, with 57 percent preferring groups of 20 or less and another 29 percent favoring groups of 20 to 30 persons (Shelby and Nielsen, 1976).

The noncommercial river runners differed from the commercial river runners in their preference for meeting other parties. They preferred fewer contacts each day and they were more likely to perceive the canyon as crowded and more impacted by the presence of man. They were also more likely to complain that they met too many people during their river experience (Shelby and Nielsen, 1976).

The combination of unregulated upstream and downstream use in the Lower Gorge area often creates congestion. This area is immediately adjacent to Lake Mead National Recreation Area and many lake travelers do not know they are in Grand Canyon National Park. Thus, the atmosphere of a recreation area is accepted and complaints of crowding are not frequent. The nature of the use of high-speed motorboats makes contacts with other groups insignificant because it is an accepted part of this type of recreation.

c. Visitor Safety

The rapids of the Colorado River are a potential safety hazard to the park visitor. Safety regulations and boat operator qualification standards have minimized accidents. In 1974, 20 accidents occurred; in 1975, 21. Of this total of 41, 15 occurred on boats, the remaining 26 occurred on hiking trips or during camp activities. The injury rate on boats is, then, one in every 2,000 passengers. The injury rate was not significantly different on oar, motor, commercial or noncommercial river trips.

The following table shows the comparative differences for on-river injury rates for both motor and non-motorized trips from 1971 to 1978.

Table 22
ON-RIVER INJURIES WHICH RESULTED IN HELICOPTER EVACUATION

Type of Craft*	YEAR								Total Injuries
	1971	1972	1973	1974	1975	1976	1977	1978	
Motorized	6	6	5	6	5	8	5	5	46
Non-Motorized	1	0	1	1	3	1	2	0	9

*The number of passengers carried on motorized and non-motorized craft during this period was about 80 and 20 percent, respectively. Motorized trips with 80 percent of the passengers had 83 percent of the injuries whereas the non-motorized trips with 20 percent of the passengers had 17 percent of the injuries. Although these data tend to indicate that non-motorized trips are safer, the difference is not statistically significant.

The motor and oar trips were perceived as equally safe by combination trip passengers (those who experienced the river trip by both motor and oar). Twenty-five percent considered the oar trip safer, 25 percent the motor, and 46 percent felt there was no difference (Shelby and Nielsen, 1976).

Accidents do occur as uninformed users attempt to run the rapids in the Lower Gorge. Though accident rates are not exceptionally high, a potential for serious problems exists if use increases and visitors are not informed of river trip hazards.

O. ECONOMIC FACTORS

1. Local and Regional Economy

The float trip concessions in Grand Canyon National Park represent a multi-million dollar industry.

The annual gross income for the 21 concessioners in recent years was:

1976 4,461,239.00
1977 4,585,455.00
1978 5,643,849.00

The effect that the river-running industry has on the local and regional economies of the Grand Canyon region has been summarized by Parent and Robeson (1976). The 22 concessioners represent 16 different base locations in four states. Data for the Parent report was taken from concessioner annual financial reports as to total taxes paid in their respective states. Letters of input to the draft environmental statement from a few concessioners indicate that the total amount paid in taxes of various kinds in the states from which they operate was actually higher than reported by Parent. Even if the amount paid were double or more it would not represent a significant proportion of the total economy those respective states involved.

Table 23
TAXES PAID BY TYPE AND CONCESSIONER LOCATION (PARENT, 1976)

Location by State				
Taxes	Arizona	California	Nevada	Utah
Real:				
State	0	423	0	0
Local	0	16	0	422
Sales:				
State	8,772	1,306	4,389	12,627
Local	0	1,275	0	0
Personal Property:				
State	1,263	119	45	0
County	368	1,363	0	7,839
Amusement Tax	0	0	0	0
License Fees	603	4,410	53	1,730
No. of Concessioners Reporting	5	6	1	9

Kane County, Utah is the base for 40 percent of the concessioners, and in Kane County the float trip concessions account for 7.4 percent of the retail sales. Although the total float trip contribution to the economy of this county is less than 1 percent of the receipts in the county, the monetary benefits could be important to that small community.

In 1975, the Hualapai Tribal river runners received revenues from transporting paying passengers from Diamond Creek to Pierce Ferry.

Visitors exiting at one of the marinas on Lake Mead contribute to the incomes of local small businesses in that area. It is assumed that persons who stay on Lake Mead make up the majority of the business for these firms, thus river travel does not significantly affect the regional or local economy centered around upper Lake Mead.

The river-running industry employs a limited number of people on a full-time basis (other than officers and managers). The majority of the employees are seasonal guides, hired to escort the paying passengers down the river. The normal river-running season is about four months long (May to August), and the majority of guides are either students or employed in other occupations during the off-season. An average river guide does not earn a total wage equal to or greater than the equivalent of a minimum yearly poverty level wage as suggested by the Arizona Department of Economic Security.

There are approximately 200 regular seasonal guides. Most of them live in other locations during the winter season. During the summer when they are on the river, they do not live predominately on the local economy (Parent and Robeson, 1976).

As a hypothetical situation, the economic impact of eliminating all commercial river trips in Grand Canyon was explored. The research results indicate that the elimination of all commercial river trips would not have a major economic impact on most communities in which these companies are based.

2. Concessioner Services, Visitor Satisfaction

Concessioners offer a wide variety of trips in terms of services offered, trip length and cost. For the 1979 season, river trips are available from 1 day at $120 to 22 days at $1,075. The highest priced trip is an 18-day oar trip at $1,350. The average cost of a full-length 13-day oar-powered trip to at least Diamond Creek for 1979 is $649 compared to an 8-day motor-powered trip to at least Diamond Creek is $571. The difference between these two average costs is $78 with the oar trip providing 4 more days on the river for this price. A wide variety of trip services are included in some of these prices in terms of food, extra equipment, special interpretation, shuttle service, motel rooms before and/or after the trip, etc. However, some of the trip prices listed do not include some of these services making direct comparison

The overwhelming majority of commercial passengers on Grand Canyon river trips feel they are getting their money's worth (Shelby and Nielsen, 1976). This is further substantiated when the average daily rate of Grand Canyon river trip concessions is compared with that charged for other recreation oriented activities at destination recreation resort areas (Parent and Robeson, 1976). The average daily rate for Grand Canyon river trips is generally less than that of other similar type activities elsewhere.

There is, however, evidence of some dissatisfaction in that 32 percent of the respondents surveyed by Shelby and Nielsen said they were willing

to pay $100 more for a trip which made fewer contacts with other trips. There is also an indication that the demand for higher priced trips appears to be greater than for lower priced trips. The company offering the highest priced trip used nearly 96 percent of its allotment. In general, passengers are able to choose from among several different products and prices, and since "values" are individually and personally perceived, there is a greater likelihood that they are being met than dictated when there is such diversity (Parent and Robeson, 1976).

P. PROBABLE FUTURE OF THE ENVIRONMENT WITHOUT THE PROPOSAL

Without the proposed plan, management of the river would continue under the present allotment and scheduling system. River recreationists would continue to float the river and experience the canyon. Negative impacts would also continue to occur on the natural, cultural, and sociological resources of the river environment.

Further deterioration of the riparian resources can be expected due to present use activities. Based on research and previous examples of misuse or unguided use, many adverse changes could eventually alter the character of the river corridor. Some of these changes are summarized below.

- Impacts related to human waste problems of the past are mitigated for the most part since the proposed carry out method has already been implemented.

- Impacts related to improper use of fires have been mitigated through the fact that the proposed fire use restrictions have been implemented.

- Impacts from multiple trailing will be partially resolved since single trail alignment has been initiated. However, full mitigation requires rescheduling of launches to reduce crowding and congestion and social trailing tendencies. Without the proposed action, crowding and congestion will continue.

- Demand for quality wilderness, the search for solitude, and the popularity of river running is expected to increase. All potential users cannot be accommodated within the river corridor, and restrictions on user allocation and numbers of visitors will continue. However, disappointment on the part of the noncommercial river runners would intensify under the past allotment ratios.

- Impacts related to operation of Glen Canyon Dam will continue and human use will accelerate some of those impacts. According to Dolan (1976), rapids are becoming more severe, beaches are eroding and human activity accelerating that erosion. Beaches are eroding more rapidly in the upper reaches of the canyon than in the lower portion, and while tributaries below the dam mitigate this process by replacing lost sediments, the long-term trend is toward loss of camping beaches.